

COMPOSITION AND STRUCTURE OF THE GROUND LAYER VEGETATION AT IROQUOIS COUNTY CONSERVATION AREA, NORTHEASTERN ILLINOIS

Loy R. Phillippe, Mary Ann Feist, Richard L. Larimore, Daniel T.
Busemeyer, Paul B. Marcum, Connie J. Carroll, James L. Ellis,
and John E. Ebinger*

1816 South Oak Street, Illinois Natural History Survey, Champaign,
Illinois 61820

*corresponding author: jeebinger@eiu.edu

ABSTRACT

The 7.8 km² Iroquois County Conservation Area in northeastern Illinois contains many of the plant communities found at this site during pre-settlement times. A sedge meadow, about 2.5 km² in size was dominated by *Carex haydenii/stricta*. The shrub sand prairie was dominated by *Carex haydenii/stricta*, but nearly 50 species encountered in the plots. In the wet-mesic sand prairies, *Rubus hispidus*, *Euthamia graminifolia*, *Potentilla simplex* and *Sorghastrum nutans* dominated, while in the dry-mesic sand prairies *Rubus hispidus*, *Schizachyrium scoparium*, *Vaccinium angustifolium* and *Sorghastrum nutans* were dominant. The ground layer vegetation of the sand flatwood communities was sparse with few species present, *Vaccinium angustifolium* and *Carex haydenii* being the most common. The sand savanna communities associated with the dunes had high species diversity. Here the ground layer vegetation varied, depending upon available moisture and shading. In the dry-mesic sand savanna *Vaccinium angustifolium*, *Pteridium aquilinum* and *Carex pensylvanica* were dominant, while in the dry sand savanna *Carex pensylvanica*, *Rhus copallina*, *Rubus allegheniensis* and *Schizachyrium scoparium* were the important species. This base line data will be used to determine management practices on the conservation area and surrounding nature preserves. *Phytologia* 91(3) 401-438 (December, 2009).

KEY WORDS: Vegetation, Iroquois County Conservation Area, Illinois, ecology, plant communities.

At the time of European settlement prairie vegetation covered about 60% of Illinois (Iverson et al. 1991). Most was "black soil" tall-grass prairie of the prairie peninsula (Transeau 1935), though sand prairies were relatively common (Schwegman 1973). These sand prairies occur in the northern half of Illinois on glacial outwash plains associated with erosional events of Wisconsin glaciation (Willman and Frye 1970, King 1981). One of the most extensive in the state is the Kankakee sand deposit in northeastern Illinois in parts of Iroquois and Kankakee counties and adjacent Newton County, Indiana.

Until relatively recently, no detailed studies of the vegetation of the Kankakee sand deposits had been undertaken. The pre-settlement vegetation of Iroquois County was studied by Hedborn (1984) while McDowell et al. (1983) described the composition and structure of the savanna communities of the Iroquois County Conservation Area. More recently, Johnson and Ebinger (1992, 1995) studied the effects of fire on the vegetation of the sand savannas at Hooper Branch Nature Preserve, Iroquois County, Illinois. The present study was undertaken to determine vascular plant species composition and structure, and the floristic quality of the ground layer vegetation of the major plant communities at the Iroquois County Conservation Area (ICCA).

DESCRIPTION OF THE STUDY SITE

The ICCA, which encompasses 7.8 km², is located in extreme northeastern Iroquois County about 6 km northeast of the town of Beaverville (S22, 23, 24 T29N R11W) in the Kankakee Sand Area Section of the Grand Prairie Natural Division of Illinois (Schwegman 1973)(Figure 1). Purchased by the Illinois Department of Conservation in 1944 as a prairie chicken sanctuary, the ICCA is now used principally as a hunting area, particularly a permit pheasant hunting area. When purchased most of the area had been heavily grazed and attempts had been made to drain the sedge meadow and marsh communities (White and Madany, 1978).

The ICCA is situated at the edge of former glacial Lake Watseka, drained about 14,500 years ago during the Kankakee Torrent, leaving sandy beaches and near shore sand deposits (Willman 1973). These sands were reworked by wind, creating the dune and swale

topography present today. The characteristic sand savanna, sand prairie, and sedge meadow vegetation became established during the Hypsithermal period about 8,000 years ago (King 1981). The soils of the ICCA are not diverse (Wascher et al. 1951, Kiefer 1982). The marshes, sedge meadows, shrub prairies, wet-mesic sand prairies, and flatwood communities that occur in depressions between the dunes are situated on Watseka loamy sands, Granby fine sandy loams, and Moracco fine sands. These soils, derived from sandy outwash sediments, are acid, peaty sand with a dark-brown to black surface horizon that are poorly drained. The soils on the dunes are Oakville fine sands that developed from sandy sediments that have a dark grayish brown surface horizon and are well drained (Kiefer 1982).

Climate at the ICCA is continental with warm summers and cold winters. Based on weather data from Kankakee, 30 km to the northwest, mean annual precipitation is 98.0 cm, with May having the highest rainfall (11.5 cm). Mean annual temperature is 9.9°C with the hottest month being July (average of 23.6°C), and the coldest January (average of -5.7°C). Frost free days range from 141 to 206, with the average being 174 days per year (Midwestern Regional Climate Center 2007).

MATERIALS AND METHODS

During the growing seasons of 2000 through 2003 the ICCA was visited numerous times, although many trips dating back to 1970 were made by one of the authors (JEE). On the trips the plants species encountered were collected, their habitat recorded, and voucher specimens deposited in the Stover-Ebinger Herbarium of Eastern Illinois University, Charleston, Illinois (EIU), or the herbarium of the Illinois Natural History Survey, Champaign, Illinois (ILLS). Criteria for designating non-native species followed Mohlenbrock (2002), and Gleason and Cronquist (1991). Nomenclature follows Mohlenbrock (2002) while Herkert and Ebinger (2002) was used for listing the Illinois endangered and threatened species.

Between 2001 and 2003 the ground layer vegetation of the major plant communities found at the ICCA was sampled by randomly locating two to four 25m transects throughout the best quality example

of each community type (White and Madany 1978). Along each transect m² plots were located at 1 m intervals (n=25/transect), odd-numbered plots to the right, even-numbered to the left. A random numbers table (0-9) was used to determine the number of m the plot was placed from the transect line. Cover of each species was determined using the Daubenmire cover class system (Daubenmire 1959) as modified by Bailey and Poulton (1968). Importance value (IV) was determined by summing relative cover and relative frequency.

The Sorensen Index of Similarity (ISs) was used to determine the degree of vegetation similarity between the areas surveyed throughout the ICCA (Mueller-Dombois and Ellenberg 1974). This index utilizes binary data (presence/absence) to measure the similarity in species composition between sites and is represented by the following equation: $[ISs = 2C/A+B \times 100]$, A equals the number of species in the first community, B equals the number of species in the second community, and C equals the number of species common between the two communities. Pairwise comparisons were made between each of the seven community types.

RESULTS

Floristic Assessment: A total of 562 taxa representing 303 genera and 97 families were documented for the ICCA (Appendix I). Fern, fern-allies and gymnosperms were represented by 17 taxa in 10 families. Of the remainder, 155 were monocots in 17 families and 72 genera, and 390 were dicots in 70 families and 220 genera. Of this total 78 non-native species were encountered (14% of all taxa), mostly in disturbed habitats. The predominant plant families were the Asteraceae with 79 taxa, the Poaceae with 67 taxa, and the Cyperaceae with 49 taxa. State endangered taxa included *Carex cumulata*, *Carex physorhyncha*, *Hypericum adpressum*, *Persicaria careyi*, *Scleria pauciflora*, *Vaccinium corymbosum*, and *Viola primulifolia* were vouchered as were the state threatened *Drosera intermedia*, *Hymenopappus scabiosaeus*, *Platanthera flava* var. *herbiola*, *Rubus schneideri*, *Sisyrinchium atlanticum* and *Veronica scutellata* (Herkert and Ebinger 2002).

Marsh: The marsh community at the ICCA was extremely small, degraded, and retained little of the original natural quality. When first observed in 1983 by one of the authors (JEE), four vegetation zones were present in this marsh: *Typha latifolia* zone; *Shoenoplectus tabernaemontani* zone; *Bolboschoenus fluviatilis* zone; and a mixed vegetation zone. The mixed vegetation zone lacked a major dominant with *Glyceria septentrionalis*, *Veronica scutellata*, *Thelypteris palustris*, *Spartina pectinata*, and *Persicaria hydropiper* dominating this zone. The other zones were dominated by a single species, few other taxa were present. Presently, due to the lowering of the water table, few of the marsh species are present at this site and the entire area is overgrown with *Phalaris arundinacea*. This area was not surveyed during the present study.

Sedge Meadow: Very homogeneous in structure and relatively low in species diversity, the sedge meadows had well developed hummocks created by the dominant species *Carex stricta* and *C. haydenii* (IV of 113 out of 200). Both species were common, and as they were not blooming when the survey was conducted, no attempt was made to distinguish them (Table 1). Some small sedge meadows were present at the ICCA, occurring in the areas between the dunes. In addition, a 2.5 km² sedge meadow exists in the southwestern quarter of the ICCA and was the one surveyed during the present study. Besides *Carex stricta/haydenii*, only two species were relatively common, *Calamagrostis canadensis* and *Persicaria coccinea*. Only 29 species were encountered in the plots, more than half with IVs of less than 1.0 (Table 1).

Shrub Sand Prairie: Only a few small examples of this community type were found at the ICCA. The ground layer of the wet-mesic shrub prairie was dominated by *Carex stricta/haydenii* (IV of 19.7) followed by *Potentilla simplex* (18.8), *Spiraea tomentosa* (14.7), *Euthamia graminifolia* (13.1), *Rubus hispidus* (12.5), *Schizachyrium scoparium* (10.8) and *Liatris spicata* (10.3) (Table 1). This community had high species diversity with 52 taxa recorded in the plots.

Wet-mesic Sand Prairie: A few wet-mesic sand prairies occurred at the ICCA, most being located adjacent to the sedge meadow community but on slightly higher ground. All of the wet-mesic prairies

examined show indications of disturbance, but species diversity was relatively high with 42 taxa occurring in the plots (Table 2). Eight species had IVs exceeding 10.0; *Rubus hispidus* (IV of 20.1), *Euthamia graminifolia* (18.3), *Potentilla simplex* (18.2), and *Sorghastrum nutans* (18.1) being the most important (Table 2).

Dry-mesic Sand Prairie: Few examples of this community were found, the only one large enough to study was located along the north edge of the ICCA. At this site, located on a lower dune slope, *Rubus hispidus* (IV of 32.8) and *Schizachyrium scoparium* dominated (31.3) followed by *Vaccinium angustifolium* (22.4), *Sorghastrum nutans* (13.3), *Aster simplex* (13.1), and *Carex pensylvanica* (13.1) with 30 other taxa found in the plots (Table 2).

Sand Flatwoods: A few small flatwoods communities occurred on the ICCA, all in depressions between dunes. *Quercus palustris* dominated the overstory of these flatwoods. The ground layer vegetation was sparse and much of the area lacked vegetation altogether as indicated by the average bare ground and litter being 87.10% (Table 1). Common species encountered were *Vaccinium angustifolium*, *Carex stricta/haydenii*, and *Rubus hispidus* with only 12 other taxa in the plots (Table 1).

Dry-mesic Sand Savanna: This community was relatively common on the lower slopes of the many dunes at the ICCA, some being of high natural quality. In this community *Quercus velutina* was the dominant overstory species but *Quercus alba* was also present, accounting for one-third to nearly half of the IV. The ground layer of this community was extremely variable depending upon past disturbances, time since the last fire, and the extent of shading. The present survey was undertaken in a dry-mesic sand savanna that had been burned in the fall of 2001 (two years prior to the survey), creating an open understory. *Vaccinium angustifolium* was the dominant species with an IV of 43.7, followed by *Pteridium aquilinum* (29.2), and *Carex pensylvanica* (24.6). Numerous seedlings of *Quercus velutina* and *Q. alba* were present accounting for these species being fourth and fifth in IV. Also various species of shrubs were common, mostly sprouts from individuals that had been top-killed by the fire (Table 3).

Dry Sand Savanna: Common on the ridges and upper slopes of the many dunes, this community was dominated by *Quercus velutina* to the almost total exclusion of other tree species. *Carex pensylvanica* (IV of 27.7) and *Schizachyrium scoparium* (13.2) were the dominant herbaceous species. Shrubs and tree seedlings were also important in the ground layer, *Rhus copallina* (24.4), *Rubus allegheniensis* (22.1) and *Quercus velutina* (12.5) were among the top five species in IV (Table 3). The ground layer of this community was diverse with 52 taxa recorded for the plots.

Sorensen Index of Similarities: The communities studied were dominated by sand prairie species with as many as 15 species in common (Table 4). The wet-mesic and dry-mesic sand prairies had relatively high species similarity (ISs = 43.59), and were similar in species composition to the sand shrub prairie (ISs = 46.80 and 50.00, respectively). Most of the communities examined show little similarity to the sedge meadow, the highest being the shrub prairie (Table 4). We expected that the dry-mesic and dry savanna would have similar species composition and a relatively high similarity index. The dry-mesic sand savanna, however, was located near the base of a dune, the soil being slightly organic. Many of the species encountered in this dry-mesic savanna were associated with the ground layer vegetation of sand flatwoods.

DISCUSSION

The ICCA contained good quality examples of many of the sand communities that are known to occur in Illinois (McDowell et al. 1983). Some of these communities are large, the sedge meadow exceeds about 2.5 km², the dry and dry-mesic savanna exceeds 2 km². Based on the surveys results, species richness was high, few exotic species were encountered in the high quality natural areas of the ICCA, and 13 Illinois endangered and threatened species were vouchered. In the communities studied sand prairie species dominated, and usually with as many as 15 species in common (Table 4).

Though 78 non-native (exotic) taxa were collected on the ICCA, few were encountered in the natural communities. Most were found along the road on the south, west, and north sides of the ICCA,

on trails and dirt roads throughout the ICCA, or in the cultural areas associated with food plots, staging areas, and roadside parking areas associated with the hunting activities at the ICCA. Among the non-native species that were found in the natural communities, *Poa pratensis* was the most common, being encountered in the sedge meadow (IV of 0.3), wet-mesic sand prairie (2.7), and dry mesic sand prairie (1.1). Other non-native species found in a few communities with very low IVs included *Achillea millefolium* and *Rumex acetosella*. In other glacial sand deposits of Illinois similar results were encountered with one to four exotics species found, most with low importance values (Handel et al. 2003; Phillippe et al. 2004, 2008; McClain et al. 2005, 2008; Ebinger et al. 2006)

The size of the ICCA, and the many examples of these communities, should allow different management practices to be tested. The present management consists of occasional burns (Johnson and Ebinger 1992, 1995). These have been sufficient to keep the dry sand savanna communities open, but have not been sufficient to keep most of the tree saplings from stump sprouting and shading the ground layer vegetation (McDowell et al. 1983). Also, the sand prairie communities have numerous tree seedlings and saplings and the size of the communities are becoming smaller due to the shade of surrounding trees. Fire frequencies should be increased, and possibly the season of the year that fire is used should be varied.

Probably the major problem now facing the ICCA is the loss of ground water due to draining efforts on the surrounding farmland and the increased use of central pivot irrigation systems. Drainage ditches are presently along the east boundary of the preserve and in the southwest corner. The de-watering of the site by these ditches has resulted in the loss of the marsh communities along the east edge of the ICCA. Also, the large sedge meadow in the southwestern part of the preserve is becoming drier, with the potential loss of some of the typical wetland species.

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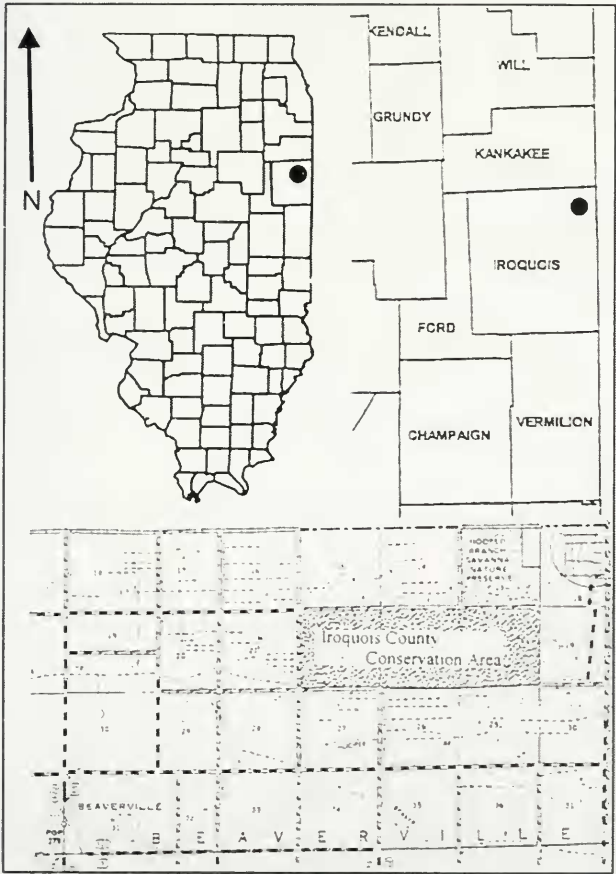


Figure 1. Location of Iroquois County Conservation Area located about 6 km northeast of the town of Beaverville, Iroquois County, Illinois.

Table 1. Frequency (%), mean cover (% of total) and importance value (I.V.) of the ground layer species encountered in the sedge meadow, shrub prairie, and sand flatwoods, Iroquois County Conservation Area, Illinois. Also given for each site is the total number of species encountered in the plots and the average number of species per plot. *Others category Include species with IV's less than 3.0.

Species	Sedge Meadow			Shrub Prairie			Sand Flatwoods		
	Freq. %	Mean cover	I.V.	Freq. %	Mean Cover	I.V.	Freq. %	Mean Cover	I.V.
<i>Carex stricta</i> /thaydenii	100	78.55	113.4	98	20.23	19.7	22	1.29	29.5
<i>Potentilla simplex</i>	--	--	--	94	19.30	18.8	--	--	--
<i>Spiraea tomentosa</i>	--	--	--	94	12.89	14.7	--	--	--
<i>Euthamia graminifolia</i>	1	0.01	0.3	96	10.00	13.1	--	--	--
<i>Rubus hispidus</i>	--	--	--	72	11.66	12.5	16	1.21	24.6
<i>Schizachyrium scoparium</i>	--	--	--	62	10.26	10.8	--	--	--
<i>Liatris spicata</i>	--	--	--	68	8.70	10.3	--	--	--
<i>Calamagrostis canadensis</i>	52	4.52	18.6	48	9.89	9.6	--	--	--
<i>Spartina pectinata</i>	6	0.31	1.9	52	8.13	8.7	--	--	--
<i>Sorghastrum nutans</i>	--	--	--	50	8.02	8.6	--	--	--
<i>Solidago gigantea</i>	2	0.04	0.6	54	3.68	6.1	--	--	--
<i>Viola primulifolia</i>	--	--	--	46	4.03	5.7	--	--	--
<i>Baptisia alba</i>	--	--	--	22	6.00	5.3	--	--	--
<i>Lysimachia lanceolata</i>	--	--	--	56	2.04	5.2	--	--	--
<i>Viola lanceolata</i>	--	--	--	56	1.70	5.0	6	0.08	4.9
<i>Polygala cruciata</i>	--	--	--	58	0.59	4.5	--	--	--
<i>Solidago nemoralis</i>	--	--	--	24	3.70	4.0	--	--	--
<i>Andropogon gerardii</i>	--	--	--	28	2.73	3.7	--	--	--
<i>Eryngium yuccifolium</i>	--	--	--	18	3.59	3.6	--	--	--
<i>Coreopsis tripteris</i>	--	--	--	32	1.58	3.3	--	--	--
<i>Vernonia gigantea</i>	--	--	--	32	1.19	3.1	--	--	--
<i>Solidago canadensis</i>	--	--	--	32	1.05	3.0	--	--	--

<i>Persicaria coccinea</i>	57	1.33	16.5	--	--	--	--	--	--
<i>Carex buxbaumii</i>	33	0.73	9.5	--	--	--	--	--	--
<i>Gallium obtusum</i>	31	1.04	9.4	18	0.19	1.4	--	--	--
<i>Hypericum sphaerocarpum</i>	23	1.77	8.1	--	--	--	--	--	--
<i>Lycopus americanus</i>	16	0.10	4.3	--	--	--	--	--	--
<i>Eleocharis verrucosa</i>	15	0.12	4.0	16	0.08	1.2	--	--	--
<i>Vaccinium angustifolium</i>	--	--	--	14	1.59	2.0	20	2.76	45.1
<i>Aronia melanocarpa</i>	--	--	--	6	0.42	0.7	12	1.03	19.9
<i>Quercus pedustris</i>	--	--	--	8	0.48	0.9	20	0.35	17.3
<i>Dichanthelium acuminatum</i>	--	--	--	--	--	--	12	0.79	17.1
<i>Drosera intermedia</i>	--	--	--	2	0.06	0.1	12	0.74	16.5
<i>Saxifraga albidum</i>	--	--	--	--	--	--	10	0.05	7.3
<i>Carex pensylvanica</i>	--	--	--	--	--	--	4	0.31	6.3
<i>Rhynchospora capitellata</i>	--	--	--	2	0.01	0.1	6	0.03	4.4
Others*	--	1.58	13.4	--	4.86	14.3	--	0.05	7.1
Totals		90.10	200.0		158.65	200.0		8.69	200.0
Average bare ground/litter		7.96			6.96			87.10	
Total species in plots	29		52				15		
Average species/plots	3.83		14.26				1.50		

Table 2. Frequency (%), mean cover (% of total) and importance value (I.V.) of the ground layer species encountered in the wet-mesic sand prairie and the dry-mesic sand prairie, Iroquois County Conservation Area, Illinois. Also given for each site is the total number of species encountered in the plots and the average number of species per plot. *Others category Include species with IVs less than 2.0.

Species	Wet-mesic Sand Prairie			Dry-mesic Sand Prairie		
	Freq. %	Mean Cover	I.V.	Freq. %	Mean Cover	I.V.
<i>Rubus hispidus</i>	92	22.90	20.1	100	16.72	32.8
<i>Euthamia graminifolia</i>	98	18.69	18.3	50	2.06	8.0
<i>Potentilla simplex</i>	98	18.57	18.2	58	1.14	7.7
<i>Sorghastrum nutans</i>	84	20.26	18.1	72	4.32	13.3
<i>Rubus schneideri</i>	84	16.84	15.8	--	--	--
<i>Carex pensylvanica</i>	98	11.71	14.2	70	4.36	13.1
<i>Schizachyrium scoparium</i>	84	12.87	13.8	92	16.43	31.3
<i>Solidago canadensis</i>	78	9.59	11.5	--	--	--
<i>Liatris spicata</i>	52	8.58	8.9	--	--	--
<i>Spiraea tomentosa</i>	66	5.85	8.4	--	--	--
<i>Coreopsis tripteris</i>	42	5.26	6.3	--	--	--
<i>Solidago gigantea</i>	56	2.74	6.0	--	--	--
<i>Bartonia virginica</i>	46	0.23	3.6	--	--	--
<i>Pycnanthemum virginianum</i>	30	1.28	3.0	--	--	--
<i>Andropogon gerardii</i>	18	2.69	3.0	26	1.30	4.5
<i>Poa pratensis</i>	28	0.97	2.7	--	--	--
<i>Spiraea alba</i>	30	0.75	2.7	--	--	--
<i>Panicum virgatum</i>	22	1.14	2.4	28	1.75	5.3
<i>Spartina pectinata</i>	24	1.10	2.4	--	--	--
<i>Aronia melanocarpa</i>	10	2.66	2.3	--	--	--
<i>Achillea millefolium</i>	24	0.66	2.2	--	--	--
<i>Galium obtusum</i>	22	0.55	2.0	--	--	--
<i>Vaccinium angustifolium</i>	--	--	--	40	13.89	22.4
<i>Aster simplex</i>	14	0.61	1.5	82	3.35	13.1

<i>Scleria triglomerata</i>	--	--	--	56	1.43	7.8
<i>Salix humilis</i>	--	--	--	40	2.59	7.6
<i>Populus tremuloides</i>	--	--	--	28	1.27	4.7
<i>Solidago nemoralis</i>	10	0.30	0.9	26	1.26	4.5
<i>Baptisia alba</i>	--	--	--	26	0.68	3.7
<i>Quercus palustris</i>	--	--	--	18	0.87	3.0
<i>Viola sagittata</i>	18	0.14	1.5	20	0.30	2.5
<i>Gentiana saponaria</i>	--	--	--	18	0.19	2.1
<i>Rhus copallina</i>	--	--	--	10	0.78	2.1
Others*	--			--		
Totals		171.43	200.0		76.29	200.0
Average bare ground/litter		6.90			24.33	
Total species in plots	42			36		
Average species/plot	13.24			9.42		

Table 3. Frequency (%), mean cover (% of total) and importance value (I.V.) of the ground layer species encountered in the dry-mesic and the dry sand savanna, Iroquois County Conservation Area, Illinois. Also given for each site is the total number of species encountered in the plots and the average number of species per plot. *Others category Include species with IVs less than 2.0.

Species	Dry-mesic Sand Savanna			Dry Sand Savanna		
	Freq. %	Mean Cover	I.V.	Freq. %	Mean Cover	I.V.
<i>Vaccinium angustifolium</i>	72	19.72	43.7	4	0.81	1.4
<i>Pteridium aquilinum</i>	58	12.00	29.2	--	--	--
<i>Carex pensylvanica</i>	74	7.20	24.6	100	15.39	27.7
<i>Quercus velutina</i>	76	5.77	22.9	50	6.59	12.5
<i>Quercus alba</i>	50	7.59	20.9	--	--	--
<i>Rubus allegheniensis</i>	50	3.12	13.9	90	11.58	22.1
<i>Rubus copallina</i>	36	3.72	12.4	86	13.74	24.4
<i>Rubus hispidus</i>	18	1.69	5.9	2	0.06	0.3
<i>Galynxssacia baccata</i>	10	1.21	3.7	--	--	--
<i>Rosa carolina</i>	16	0.43	3.6	42	1.29	5.4
<i>Euphorbia corollata</i>	18	0.14	3.5	62	2.47	8.7
<i>Lespedeza hirta</i>	8	0.67	2.4	4	0.07	0.5
<i>Schizachyrium scoparium</i>	6	0.13	1.3	56	6.67	13.2
<i>Chamaecrista nictitans</i>	2	0.01	0.4	76	1.71	9.0

<i>Sporobolus cryptandrus</i>	--	--	--	--	36	3.67	7.7
<i>Helianthemum bicknellii</i>	--	--	--	--	46	2.23	7.0
<i>Lespedeza capitata</i>	--	--	--	--	34	1.73	5.2
<i>Lithospermum croceum</i>	--	--	--	--	24	1.87	4.4
<i>Dichanthelium villosissimum</i>	--	--	--	--	32	0.75	3.8
<i>Galium pilosum</i>	--	--	--	--	26	1.06	3.7
<i>Prunus serotina</i>	2	0.30	0.9	0.9	14	2.02	3.7
<i>Koeleria macrantha</i>	--	--	--	--	22	1.33	3.6
<i>Dichanthelium oligosanthes</i>	--	--	--	--	32	0.41	3.4
<i>Rumex acetosella</i>	--	--	--	--	26	0.63	3.2
<i>Cyperus lupulinus</i>	--	--	--	--	28	0.14	2.8
<i>Potentilla simplex</i>	6	0.13	1.3	1.3	16	1.20	2.8
<i>Polygala polygama</i>	8	0.09	1.5	1.5	22	0.26	2.3
<i>Asclepias verticillata</i>	--	--	--	--	20	0.15	2.1
<i>Aureolaria pedicularia</i>	--	--	--	--	8	1.20	2.1
<i>Corylus americana</i>	--	--	--	--	4	1.31	2.0
Others*	--	0.54	7.9	7.9	--	3.31	15.0
Totals		64.46	200.0	200.0		83.65	200.0
Average bare ground/litter		41.20				14.22	
Total species in plots	28				52		
Average species/plot	5.48				10.78		

Table 4. Sorensen Index of Similarity of the ground layer vegetation of the seven communities examined, Iroquois County Conservation Area, Illinois.

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
Area 1 - Sedge Meadow						
Area 2 - Shrub Prairie	27.16					
Area 3 - Wet-mesic Prairie	20.00	46.80				
Area 4 - Dry-mesic Prairie	6.15	50.00	43.59			
Area 5 - Sand Flatwoods	4.55	26.87	21.05	27.45		
Area 6 - Dry-mesic Savanna	0.00	17.50	14.29	25.00	18.60	
Area 7 - Dry Savanna	0.00	11.54	10.64	11.36	8.96	30.00

APPENDIX 1: The vascular taxa encountered and collected at the Iroquois County Conservation Area are listed below by major groups. Pteridophytes (ferns and fern-allies) and Spermatophytes (seed plants), the latter divided into Monocots and Dicots. The families, genera, and species are alphabetically arranged within each group. Non-native species are indicated by an asterisk (*). After the binomial and authority, the communities where the species was observed is given (1 = marsh, 2 = sedge meadow, 3 = sand flatwoods, 4 = wet sand prairie, 5 = mesic sand prairie, 6 = dry-mesic sand prairie, 7 = dry sand prairie, 8 = shrub prairie, 9 = dry-mesic sand savanna, 10 = dry sand savanna, 11 = cultural). Following the community number(s), collecting numbers

or date collected (when collecting number not assigned) preceded by the initial of the collector's name are given (E for John E. Ebinger, Ev for Robert A. Evers, F for Mary Ann Feist, H for Fran Harty, M for Michael H. Madany, and P for Loy R. Phillippe).

PTERIDOPHYTES

ASPLENIACEAE

Asplenium platyneuron (L.) Oakes: 9; E21827

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) Underw.: 7, 10; E21277

DRYOPTERIDACEAE

Dryopteris carthusiana (Villars) H.P. Fuchs: 3; P33033

Dryopteris cristata (L.) Gray: 3; P33036

EQUISETACEAE

Equisetum arvense L.: 2, 3, 4, 12; E21630

Equisetum fluviatile L.: 3, 11; E22008

Equisetum hyemale L.: 7, 9, 10; E22649

Equisetum laevigatum A. Br.: 7, 9, 10, 11; E21957

LYCOPODIACEAE

Lycopodium hickeyi Wagner, Beitel & Moran: 8; H11 October 2001; P33825

ONOCLEACEAE

Onoclea sensibilis L.: 2; E22332

OPHIOGLOSSACEAE

Botrychium dissectum Spreng.: 11; P36267

Botrychium virginianum (L.) Sw.: 3; P33038

Ophioglossum pusillum Raf.: 2, 3, 4, 5; P32965

OSMUNDACEAE

Osmunda cinnamomea L.: 3; P33276

Osmunda regalis L.: 3, 8; E21240

THELYPTERIDACEAE

Thelypteris palustris Schott: 2, 8; E22276

SPERMATOPHYTES: GYMNOSPERMS

PINACEAE

**Pinus banksiana* Lamb.: 11; P33826

SPERMATOPHYTES: ANGIOSPERMS

DICOTS

ACERACEAE

Acer negundo L.: 11; E21944

Acer saccharinum L.: 11; E21939

AMARANTHACEAE

Amaranthus albus L.: 11; Ev84994

Amaranthus tuberculatus (Moq.) J. Sauer: 11; E22633

ANACARDIACEAE

Rhus copallina L.: 6, 7, 9, 10; E21250

Rhus glabra L.: 6, 7, 9, 10, 11; E21289

Rhus hirta L.: 6, 7, 9, 10, 11; E21920

Toxicodendron radicans (L.) Kuntze: 11; P30985

Toxicodendron vernix (L.) Kuntze: 5; P33630

APIACEAE

Cicuta bulbifera L.: 2; P36259

Cicuta maculata L.: 2; E22000

**Daucus carota* L.: 11; E22296

Eryngium yuccifolium Michx.: 4, 5, 8; E22302

Osmorhiza claytonii (Michx.) C.B. Clarke: 11; E21623

Osmorhiza longistylis (Torr.) DC.: 10; P33643

Oxypolis rigidior (L.) Raf.: 8; E22587

**Pastinaca sativa* L.: 11; E21945

Sanicula canadensis L.: 11; E21932

Sium suave Walt.: 11; E22264

APOCYNACEAE

Apocynum androsaemifolium L.: 9, 10; E21968

AQUIFOLIACEAE

Ilex verticillata (L.) Gray: 3, 9; E21516

ASCLEPIADACEAE

Asclepias amplexicaulis Small: 7, 10; E21276

Asclepias hirtella (Pennell) Woodson: 8; E22326

Asclepias incarnata L.: 2, 11; E22278

Asclepias syriaca L.: 11; E22294

Asclepias tuberosa L.: 9, 10; E21270

Asclepias verticillata L.: 6, 7, 8, 9, 10, 11; E21253

ASTERACEAE

**Achillea millefolium* L.: 5, 6, 7, 8, 9, 10, 11; E21287

Ambrosia artemisiifolia L.: 11; E22404

Ambrosia trifida L.: 11; P33647

Antennaria neglecta Greene: 5, 6; P32960

Antennaria plantaginifolia (L.) Hook.: 7, 9, 10; E21588

Arnoglossum plantagineum Raf.: 2, 4, 5; E22011

**Artemisia absinthium* L.: 11; P33660

Aster dumosus L. var. *strictior* Torrey & Gray: 2, 3, 9; E22464

Aster ericoides L.: 8; sight record only

Aster lanceolatus Willd. var. *simplex* (Willd.) A.G. Jones: 3, 5, 6, 8; E22578

Aster novae-angliae L.: 2, 5, 8; E22571

Aster oolentagiensis Riddell: 7, 9, 10, 11; E21502

Aster parviceps (Burgess) Mack. & Bush: 6; E22411

Aster praealtus Poir.: 8, 11; E22632

Bidens aristosa (Michx.) Britt.: 3, 11; E22591

Bidens cernua L.: 1, 11; E22503

Bidens comosa (Gray) Wieg.: 1, 11; E22474

Bidens coronata (L.) Britt.: 4, 11; Ev85010

Bidens frondosa L.: 11; P36270

Boltonia asteroides (L.) L'Hér.: 11; E22645

**Cichorium intybus* L.: 11; E30035

**Cirsium arvense* (L.) Scop.: 11; E21947

Cirsium discolor (Muhl.) Spreng.: 11; E22407

- Cirsium muticum* Michx.: 2; E22446
Conyza canadensis (L.) Cronq.: 8, 9, 10, 11; P33617
Coreopsis palmata Nutt.: 7, 9, 10, 11; E21278
Coreopsis tripteris L.: 5, 6, 8; E22575
Doellingeria umbellata (Mill.) Nees: 2, 4; P33627
Erechtites hieracifolia (L.) Raf.: 11; E22467
Erigeron annuus (L.) Pers.: 11; E21962
Erigeron strigosus Muhl.: 6, 7, 8, 9, 10; E21257
Eupatoriadelphus maculatus (L.) R.M. King & H. Rob.: 2; E22343
Eupatorium altissimum L.: 5, 11; P33661
Eupatorium perfoliatum L.: 1, 8; E22492
Eupatorium serotinum Michx.: 1, 3; E22491
Eupatorium sessilifolium L.: 9; P33634
Euthamia graminifolia (L.) Nutt.: 2, 5, 6, 8; E21512
Euthamia gymnospermoides Greene: 11; Ev85037
Helenium autumnale L.: 4, 8; E22574
Helianthus divaricatus L.: 7, 10, 11; E22290
Helianthus giganteus L.: 2, 11; E22348
Helianthus grosseserratus Martens: 5; P33625
Helianthus mollis Lam.: 7, 8, 9, 10; E21499
Helianthus occidentalis Riddell: 7, 8, 9, 10; E22274
Helianthus strumosus L.: 8; E22583
Hieracium gronovii L.: 7, 8, 9, 10; E22325
Hieracium longipilum Torr.: 6, 11; E22284
Hieracium scabrum Michx.: 7, 9, 10; P33620
Hymenopappus scabiosaeus L'Hér.: 6, 9, 11; E21282
Ionactis linariifolius (L.) Greene: 7, 9, 10; E22514
Krigia biflora (Walt.) Blake: 2, 8; E21813
Krigia virginica (L.) Willd.: 6, 11; E21244
Lactuca canadensis L.: 5, 6, 7, 10; E22419
Lactuca floridana (L.) Gaertn.: 9; P33652
**Lactuca serriola* L.: 11; E22350
Liatris spicata (L.) Willd.: 5, 6, 8, 9, 10; E22328
**Matricaria discoidea* DC.: 11; E21953
Oligoneuron riddellii (Frank) Rydb.: 5; P33629
Parthenium integrifolium L.: 8; E21233
Pseudognaphalium obtusifolium (L.) Hilliard & Burt: 5, 7, 9, 10; E22511
Rudbeckia hirta L.: 8; E 21237, E21840

- Rudbeckia subtomentosa* Pursh: 5; P33653
Rudbeckia triloba L.: 11; P33464
Senecio pauperculus Michx.: 5; P32948
Senecio plattensis Nutt.: 11; E21633
Silphium integrifolium Michx.: 8; E22301
Solidago canadensis L.: 5, 8; sight record only
Solidago gigantea Ait.: 2, 5, 8, 11; E22428
Solidago missouriensis Ait.: 5, 8, 9; E22318
Solidago nemoralis Ait.: 5, 6, 8, 9, 10, 11; E22417
Solidago rugosa Mill.: 3, 9; P36249
Solidago speciosa Nutt.: 6, 7, 10; E22504
**Sonchus arvensis* L. var. *glabrescens* Grab. & Wimm.: 11; P33404
**Taraxacum officinale* Weber: 11; E21607
**Tragopogon dubius* Scop.: 11; E21889
Vernonia fasciculata Michx.: 2; P33667
Vernonia gigantea (Walt.) Trel.: 6, 8; E22551
Vernonia missurica Raf.: 4; P33482
Xanthium strumarium L.: 11; E22457

BALSAMINACEAE

- Impatiens capensis* Meerb.: 3, 9, 11; P33636

BETULACEAE

- Betula nigra* L.: 3, 9, 11; E21926

BORAGINACEAE

- Hackelia virginiana* (L.) I.M. Johnston: 11; P33639
Lithospermum croceum Fern.: 6, 7, 9, 10; E21268
Myosotis verna Nutt.: 11; E21871

BRASSICACEAE

- **Alliaria petiolata* (Bied.) Cavara & Grande: 11; P33044
**Arabidopsis thaliana* (L.) Heynh.: 9, 11; E21271
Arabis lyrata L.: 9, 10; P32941
**Barbarea vulgaris* R. Br.: 11; E21625
**Capsella bursa-pastoris* (L.) Medic.: 11; E21616
Cardamine bulbosa (Muhl.) BSP.: 2; E21594
Cardamine parviflora L.: 11; E21208
Cardamine pensylvanica Muhl.: 11; E21632

Draba reptans (Lam.) Fern.: 11; E21610

**Lepidium campestre* (L.) R. Br.: 11; F974

Lepidium virginicum L.: 11; E21610

Neobeckia aquatica Eaton: 1, 2; E21817

Rorippa palustris (L.) Besser var. *fernaldiana* (Butters & Abbe)

Stuckey: 2, 11; E21808

Rorippa palustris (L.) Besser var. *hispida* (Desv.) Rydb.: 6, 11;

Ev87557

**Sisymbrium altissimum* L.: 11; Ev87581

CAESALPINACEAE

Chamaecrista fasciculata (Michx.) Greene: 6, 7, 9, 10; E22269

Chamaecrista nictitans (L.) Moench: 7, 9, 10; E21495

CALLITRICHACEAE

Callitriche heterophylla Pursh: 11; E21600

Callitriche terrestris Raf.: 11; E21950

CAMPANULACEAE

Campanula aparinoides Pursh: 2; E22270

Campanulastrum americanum (L.) Small: 9; P33637

Lobelia cardinalis L.: 11; E22631

Lobelia siphilitica L.: 11; E22471

Lobelia spicata Lam.: 6, 7, 8, 9, 10; E21262

Triodanis perfoliata (L.) Nieuwl.: 11; E21877

CAPRIFOLIACEAE

**Lonicera maackii* (Rupr.) Maxim.: 11; E30036

**Lonicera morrowii* Gray: 2, 11; P32968

**Lonicera tatarica* L.: 11; E21617

Sambucus canadensis L.: 11; E21948

**Viburnum opulus* L.: 11; P33633

CARYOPHYLLACEAE

**Cerastium fontnum* Baum: 11; E21612

**Dianthus armeria* L.: 11; E21295

**Holosteum umbellatum* L.: 11; P32966

Moehringia lateriflora (L.) Fenzl: 7, 10; E21591

Paronychia canadensis (L.) Wood: 3, 9, 10; P33397

**Saponaria officinalis* L.: 11; E22295

Silene antirrhina L.: 11; E21888

**Silene pratensis* (Spreng.) Godron & Gren.: 11; E21925

Silene stellata (L.) Ait. f.: 7, 10, 11; E22285

CELASTRACEAE

Celastrus scandens L.: 10; P36271

CERATOPHYLLACEAE

Ceratophyllum demersum L.: 11; P33657

CHENOPODIACEAE

Chenopodium desiccatum A. Nels.: 7, 9, 10; E22516

Chenopodium simplex (Torr.) Raf.: 11; P33280

Cycloma atriplicifolium (Spreng.) Coult.: 11; E22406

CISTACEAE

Helianthemum bicknellii Fern.: 7, 9, 10, 11; E21507

Helianthemum canadense (L.) Michx.: 7, 9, 10; E21263

Lechea mucronata Raf.: 7, 9, 10; P33471

Lechea pulchella Raf.: 5, 6, 9; E22347

CONVOLVULACEAE

Calystegia sepium (L.) R. Br.: 11; E21940

CORNACEAE

Cornus obliqua Raf.: 2, 4; E21825

Cornus racemosa Lam.: 2, 3, 4, 8, 11; P33059

CORYLACEAE

Corylus americana Walt.: 7, 9, 10; E21285

CUSCUTACEAE

Cuscuta glomerata Choisy: 2, 4; P33670

Cuscuta gronovii Willd.: 1, 11; E22472

DROSERACEAE

Drosera intermedia Hayne: 3, 5, 8; P33405

ELAEAGNACEAE

**Elaeagnus umbellata* Thunb.: 11; E21924

ERICACEAE

Gaylussacia baccata (Wang.) K. Koch: 9; P33270

Vaccinium angustifolium Ait.: 3, 6, 8, 9; E 1586

Vaccinium corymbosum L.: 6; P33819

Vaccinium pallidum Ait.: 3, 9; E22553

EUPHORBIACEAE

Acalypha gracilens Gray: 9, 11; P33621

Acalypha rhomboidea Raf.: 11; E22462

Chamaesyce maculata (L.) Small: 11; P33665

Chamaesyce nutans (Lag.) Small: 11; P33662

Euphorbia corollata L.: 6, 7, 8, 9, 10, 11; E21231

Poinsettia dentata (Michx.) Kl. & Garcke: 11; E30039

FABACEAE

Amorpha canescens Pursh: 7, 9, 10; E21274

Baptisia alba (L.) Vent.: 6, 8, 9; E21267

Desmodium canadense (L.) DC.: 5; P33626

Desmodium obtusum (Muhl.) DC.: 7, 10; E22518

Desmodium paniculatum (L.) DC.: 7, 10; E22412

Desmodium sessilifolium (Torr.) Torr. & Gray: 7, 9, 10; E22548

Lathyrus palustris L.: 2, 6, 11; E21896

Lespedeza capitata Michx.: 6, 7, 9, 10; E21508

Lespedeza hirta (L.) Hornem.: 7, 9, 10; P33623

Lespedeza hirta (L.) Hornem. X *L. longifolia* DC.: 9; P33624

Lespedeza virginica (L.) Britt.: 9; P33699

Lupinus perennis L.: 10, 11; E21613

**Medicago lupulina* L.: 11; P33260

**Medicago sativa* L.: 11; E21860

**Melilotus albus* Medik.: 11; E30040

**Melilotus officinalis* (L.) Pallas: 11; E21874

**Robinia pseudoacacia* L.: 11; E21927

Tephrosia virginiana (L.) Pers.: 7, 9, 10, 11; E21306

**Trifolium pratense* L.: 11; E21882

**Trifolium repens* L.: 11; E21858

**Vicia villosa* Roth: 11; E30041

FAGACEAE

Quercus alba L.: 6, 9; E21264

Quercus palustris Muenchh.: 3, 6, 8; sight record only

Quercus velutina Lam.: 6, 7, 9, 10; E21307

GENTIANACEAE

Bartonia virginica (L.) BSP.: 3, 5, 6, 8, 9; P33402

Gentiana saponaria L.: 6, 8; E21510

HALORAGIDACEAE

Proserpinaca palustris L.: 3, 11; P32958

HYPERICACEAE

Hypericum adpressum Bart.: 4, 5, 8; E22321

Hypericum canadense L.: 8, 11; E21288

Hypericum gentianoides (L.) BSP.: 6, 7, 11; E22566

Hypericum mutilum L.: 8, 11; E22293

**Hypericum perforatum* L.: 11; E30038

Hypericum punctatum Lam.: 11; P36268

Hypericum sphaerocarpum Michx.: 2, 4; P33216

Triadenum fraseri (Spach) Gl.: 2; E22330

JUGLANDACEAE

Juglans nigra L.: 11; E21941

LAMIACEAE

Hedeoma hispida Pursh: 11; P33265

**Leonurus cardiaca* L.: 11; E21928

Lycopus americanus Muhl.: 1, 2, 11; E22445

Lycopus virginicus L.: 1, 2; E22331

**Mentha arvensis* L.: 1, 2; E22436

Monarda fistulosa L.: 11; E22283

Monarda punctata L.: 6, 7, 10; E21272

**Nepetea cataria* L.: 11; P33279

Physostegia virginiana (L.) Benth.: 6, 8; E22430

Prunella vulgaris L.: 11; P33644

Pycnanthemum virginianum (L.) Dur. & B.D. Jacks.: 2, 5; E22279

Scutellaria galericulata L.: 2; E22014

Scutellaria lateriflora L.: 1, 2, 3; E22494

Stachys tenuifolia Willd.: 1, 2, 8; E22323

Teucrium canadense L. var. *canadense*: 9, 10, 11; P33264

LAURACEAE

Sassafras albidum (Nutt.) Nees: 9, 10, 11; E21615

LINACEAE

Linum medium (Planch.) Britt.: 11; P33400

LYTHRACEAE

Lythrum alatum Pursh: 2, 8, 11; E21239

Rotala ramosior (L.) Koehne: 11; E22310B

MELASTOMACEAE

Rhexia virginica L.: 5, 6, 8, 11; E22319

MOLLUGINACEAE

**Mollugo verticillata* L.: 6, 11; E22418

MORACEAE

**Machura pomifera* (Raf.) Schneider: 11; E21937

**Morus alba* L.: 11; E21943

NYCTAGINACEAE

**Mirabilis nyctaginea* (Michx.) MacM.: 11; E21876

NYSSACEAE

Nyssa sylvatica Marsh.: 3, 4; P32954

OLEACEAE

Fraxinus pennsylvanica Marsh.: 1, 2, 3; P29930

ONAGRACEAE

Circaea lutetiana L.: 3; P33277

Epilobium coloratum Biehler: 2; Ev85008

Epilobium leptophyllum Raf.: 2; E22448

Ludwigia alternifolia L.: 8, 11; E212971

Ludwigia palustris (L.) Ell.: 11; E22289

Ludwigia polycarpa Short & Peter: 11; E22481

Oenothera biennis L.: 11; E22346

Oenothera clelandii W. Dietr., Raven & W.L. Wagner: 7,9,10: E21260

Oenothera pilosella Raf.: 4, 5, 8; E21843

OXALIDACEAE

Oxalis fontana Bunge: 11; E21936

Oxalis stricta L.: 5, 11; E21868

PHRYMACEAE

Phryma leptostachya L.: 9, 10; P33638

PHYTOLACCACEAE

Phytolacca americana L.: 11; P33262

PLANTAGINACEAE

Plantago aristata Michx.: 11; P33263

**Plantago lanceolata* L.: 11; E21883

Plantago patagonica Jacq.: 7, 9, 10; E21977

Plantago rugelii Decne.: 11; E21946

POLEMONIACEAE

Phlox bifida Beck: 7, 9, 10; E21582

Phlox glaberrima L.: 2, 4, 8; E21232

POLYGALACEAE

Polygala cruciata L.: 3, 8, 11; E21518

Polygala polygama Walt.: 8, 11; E21905

Polygala sanguinea L.: 5; P30002

POLYGONACEAE

Antenoron virginianum (L.) Roberty & Vautier: 11; P33650

**Fallopia convolvulus* (L.) A. Löve: 11; E21963

Fallopia cristata (Engelm. & Gray) Holub.: 11; P33648

Persicaria amphibium (L.) S.F. Gray: 2, 4; P33705

Persicaria careyi (Olney) Greene: 3, 11; P33477

**Persicaria cespitosa* (Blume) Nakai: 11; E22286

Persicaria hydropiperoides Michx.: 1, 2, 11; E22344

Persicaria lapathifolia (L.) S.F. Gray: 2, 11; E22454

Persicaria opelousana (Riddell) Small: 2, 12; P33484

Persicaria pensylvanica (L.) Small: 11; E22639

Persicaria punctata (Ell.) Small: 2, 3; E22440

Persicaria setacea (Baldw.) Small: 1, 11; E22473

**Persicaria vulgaris* Webb & Moq.: 11; E30043

Polygonella articulata (L.) Meisn.: 7, 10; E22450

**Polygonum aviculare* L.: 11; E22305

Polygonum ramosissimum Michx.: 2; P33666

Polygonum tenue Michx.: 7, 9, 10; P33470

**Rumex acetosella* L.: 6, 7, 9, 10, 11; E21252

**Rumex crispus* L.: 11; E21866

Tracaulon sagittatum (L.) Small: 2; E22435

PORTULACACEAE

Claytonia virginica L.: 9, 10; E21583

**Portulaca oleracea* L.: 11; E22266

Talinum rugospermum Holz.: 7, 9, 10; P33406

PRIMULACEAE

Lysimachia hybrida Michx.: 2; P33479

Lysimachia lanceolata Walt.: 2, 8, 9; E22327

Lysimachia quadriflora Sims: 2, 4; P33274

Lysimachia terrestris (L.) BSP.: 4; E22006

Lysimachia thyrsiflora L.: 1, 2; E21826

RANUNCULACEAE

Anemone canadensis L.: 11; E21898

Anemone cylindrica Gray: 7, 9, 10; E21273

Anemone quinquefolia L.: 9; E21578

Caltha palustris L.: 2; E21596

Ranunculus abortivus L.: 11; E21627

Ranunculus flabellaris Raf.: 11; E21599

Ranunculus longirostris Godr.: 11; P32968.1

Ranunculus pusillus Poir.: 11; P32957

Thalictrum revolutum DC.: 8, 11; E21861

RHAMNACEAE

Ceanothus americanus L.: 7, 9, 10; E21266

**Frangula alnus* Mill.: 2; P33669

**Rhamnus cathartica* L.: 11; P33278

ROSACEAE

Agrimonia parviflora Sol.: 2, 5; E22434

Aronia melanocarpa (Michx.) Ell.: 5, 8, 9, 11; E21301

Fragaria virginiana Duchesne: 11; E21606

Geum aleppicum Jacq.: 11; E21897

Geum canadense Jacq.: 11; P33649

Geum laciniatum Murr.: 11; E21959

Malus ioensis (Wood) Britt.: 11; E21620

**Malus prunifolia* (Willd.) Borkh.: 11; P33654

Physocarpus opulifolius (L.) Maxim.: 11; E21917

Potentilla norvegica L.: 11; E30044

Potentilla simplex Michx.: 2, 5, 6, 8, 9, 10, 11; E21602

Prunus americana Marsh.: 11; E21622

Prunus serotina Ehrh.: 9, 10, 11; E21300

Prunus virginiana L.: 11; P36266

Rosa carolina L.: 7, 8, 9, 10, 11; E21275

**Rosa multiflora* Thunb.: 11; E21866

Rosa palustris Marsh.: 2, 4, 5, 8; P33217

Rubus allegheniensis Porter: 6, 9, 10, 11; E21292

Rubus flagellaris Willd.: 2, 8, 9, 10, 11; E21290

Rubus hispidus L.: 5, 6, 8, 11; E21901

Rubus occidentalis L.: 9, 10, 11; P32967

Rubus schneideri Bailey: 4, 5, 8; F990

Spiraea alba Du Roi: 2, 3, 5, 8, 11; E22268

Spiraea tomentosa L.: 5, 6, 8, 9; E21517

RUBIACEAE

Cephalanthus occidentalis L.: 1; E22337

Galium aparine L.: 11; E21624

Galium boreale L.: 1, 2, 4; Ev87573

Galium circaezans Michx.: 9, 10; P33642

Galium obtusum Bigel.: 1, 2, 4, 5, 8; E22496

Galium pilosum Ait.: 9; E21501

Galium tinctorium L.: 2; P33480

Houstonia caerulea (L.) Hook.: 11; E21603

RUTACEAE

Ptelea trifoliata L.: 11; P33220

SALICACEAE

Populus deltoides Marsh.: 2, 11; E21915

Populus grandidentata Michx.: 3, 9, 11; E21930

Populus tremuloides Michx.: 6, 8, 9, 11; E21286

Salix bebbiana Sarg.: 2; M 8 July 1977

Salix discolor Muhl.: 8; E21998

Salix humilis Marsh.: 6, 8, 9, 10, 11; E21579

Salix interior Rowlee: 2; E21824

Salix nigra Marsh.: 11; E21938

Salix petiolaris Sm.: 5; Ev87568

Salix rigida Muhl.: 11; E21609

Salix sericea Marsh.: 5, 8; E21838

SANTALACEAE

Comandra umbellata (L.) Nutt.: 6; E21581

SAXIFRAGACEAE

Heuchera americana L.: 9; E21831

Heuchera richardsonii R. Br.: 7 ; Ev87528

Penthorum sedoides L.: 1; E22333

Saxifraga pensylvanica L.: 4, 5; P32962

SCROPHULARIACEAE

Agalinis purpurea (L.) Pennell: 6, 8, 11; E22541

Agalinis tenuifolia (Vahl) Raf.: 11; E22468

Aureolaria pedicularia L.: 6, 9, 10; E22525

Gratiola neglecta Torr.: 11; E21908

Leucospora multifida (Michx.) Nutt.: 11; Ev85065

Lindernia anagallidea (Michx.) Pennell: 11; E22458

Mimulus ringens L.: 1, 11; E22335

Nuttallanthus canadensis (L.) D. Sutton: 7, 8, 9, 10; E21248

Pedicularis canadensis L.: 8; E21992

Pedicularis lanceolata Michx.: 2; E22576

Penstemon digitalis Nutt.: 11; E21865

Scrophularia lanceolata Pursh: 9, 10; E21265

**Verbascum thapsus* L.: 3, 11; E30045

**Veronica arvensis* L.: 11; E21629

Veronica peregrina L.: 11; E21628

Veronica scutellata L.: 1, 2, 4, 11; E21816

Veronicastrum virginicum (L.) Farw.: 8, 11; E22265

SOLANACEAE

Physalis heterophylla Nees: 11; E21942

Physalis virginiana Mill.: 11; E21965

Solanum carolinense L.: 11; E21933

**Solanum dulcamara* L.: 2; E21810

Solanum prichanthum Dunal: 2, 3; P33616

ULMACEAE

Celtis occidentalis L.: 11; P33659

Ulmus americana L.: 2, 11; E22001

**Ulmus pumila* L.: 11; E30046

URTICACEAE

Boehmeria cylindrica (L.) Sw.: 1, 2, 11; E22334

Parietaria pensylvanica Muhl.: 11; E21304

Pilea pumila (L.) Gray: 9; P36269

VERBENACEAE

Phyla lanceolata (Michx.) Greene: 11; E22303

Verbena bracteata Lag. & Rodr.: 11; E21302

Verbena hastata L.: 2, 8; E22282

Verbena urticifolia L.: 11; P33646

VIOLACEAE

Viola lanceolata L.: 5, 6, 8; E21593

Viola pedata L.: 7, 9, 10; E21585

Viola pratensis Greene: 9, 11; E21589

Viola primulifolia L.: 3, 5, 6, 8, 11; E21988

Viola sagittata Ait.: 5, 6, 7, 8, 9, 10; E21580

Viola sororia Willd.: 8, 9, 10; E21592

VITACEAE

Parthenocissus quinquefolia (L.) Planch.: 11; E21934

Vitis riparia Michx.: 3, 9, 10; P33701

MONOCOTS

ACORACEAE

Acorus americanus (Raf.) Raf.: 4, 11; P33062

ALISMATACEAE

Alisma subcordatum Raf.: 1; E22340

Sagittaria latifolia Willd.: 11; P33655

AMARYLLIDACEAE

Hypoxis hirsuta (L.) Coville: 6, 7; Ev87576

COMMELINACEAE

Commelina erecta L.: 6, 7, 10, 11; E21243

Tradescantia ohimensis Raf.: 6, 7, 9, 10, 11; E21256

CYPERACEAE

Bulbostylis capillaris (L.) C.B. Clarke: 6; P33821

Carex bebbii Olney: 6; E21261

Carex blanda Dewey: 9, 10; P32956

Carex brachyglossa Mack.: 5; F981

Carex brevior (Dewey) Mack.: 5, 11; E21912

Carex buxbaumii Wahlenb.: 2, 3, 4; E21597

Carex cephalophora Muhl.: 3, 9, 10; P33051

Carex crawei Dewey: 5, 11; E21881

Carex cumulata (L.H. Bailey) Fern.: 3; P36256

Carex emmonsii Dewey: 3, 5; P32943

Carex festucacea Schk.: 3; P33053

Carex foenea Willd.: 9; E21590

Carex haydenii Dewey: 2, 3, 4, 5; P32946

Carex interior L.H. Bailey: 4, 5; P32951

Carex lupuliformis Sartw.: 2; E22341

Carex molesta Mack.: 4; P33055

Carex muhlenbergii Schk.: 7, 10, 11; E21255

Carex normalis Mack.: 5; F975

Carex pellita Willd.: 2; E21595

Carex pensylvanica Lam.: 7, 9, 10; E21584

Carex physorhyncha Liebm.: 7, 8, 9, 10, 11; E21851

- Carex sartwellii* Dewey: 2; P32961
Carex scoparia Schk.: 2, 11; E21822
Carex stricta Lam.: 2; E21598
Carex suberecta (Olney) Britt.: 2, 3, 4, 5, 9; P32955
Carex swanii (Fern.) Mack.: 6, 9; E21247
Carex umbellata Schk.: 5, 6; P32963
Carex vesicaria L.: 4; P33063
Carex vulpinoidea Michx.: 11; E21880
Cyperus bipartitus Torr.: 11; E22643
Cyperus erythrorhizos Muhl.: 11; E22478
Cyperus lupulinus (Spreng.) Marcks: 6, 7, 10; E21246
Cyperus schweinitzii Torr.: 6, 7, 10; E21242
Cyperus squarrosus L.: 11; E22636
Cyperus strigosus L.: 11; E22461
Eleocharis acicularis (L.) Roem. & Schultes: 12; E22637
Eleocharis erythropoda Steud.: 1, 2; E21822
Eleocharis ovata (Roth) Roem.: 11; E21298
Eleocharis verrucosa (Svenson) Harms: 1, 2, 4, 5, 8, 12; E21895
Eleocharis wolfii Gray: 2, 3, 4; P33048
Fimbristylis autumnalis (L.) Roem. & Schultes: 11; E22455
Fimbristylis puberula (Michx.) Vahl: 11; Ev87587
Hemicarpha micranthus (Vahl) Pax: 11; E22309
Rhynchospora capitellata (Michx.) Vahl: 3, 5, 8, 11; E21291
Schoenoplectus acutus (Muhl.) A. Löve & D. Löve: 1; E21972
Scirpus cyperinus (L.) Kunth: 2, 4, 11; P33615
Scirpus pendulus Muhl.: 11; E21885
Scleria pauciflora Muhl. var. *caroliniana* (Willd.) Wood: 6, 9; P33403
Scleria triglomerata Michx.: 5, 6, 8, 10; P33401

HYDROCHARITACEAE

- Elodea canadensis* L.C. Rich.: 11; E30047

IRIDACEAE

- Iris shrevei* Small: 2, 5; E21807
Sisyrinchium albidum Raf.: 6, 11; E21576
Sisyrinchium atlanticum Bickn.: 5, 8; E21986

JUNCACEAE

- Juncus acuminatus* Michx.: 2, 11; E21296
Juncus brachycarpus Engelm.: 11; Ev85014
Juncus bufonius L.: 11; F973.2
Juncus canadensis J. Gay: 1, 8; E22487
Juncus dudleyi Wieg.: 2, 5, 6; E21806
Juncus greenii Oakes & Tuckerm.: 6; E21235
Juncus marginatus Rostk.: 8; E21993
Juncus nodosus L.: 11; Ev81372
Juncus tenuis Willd.: 9, 10, 11; E21952

LEMNACEAE

- Lemna minor* L.: 11; E30048
Spirodela polyrrhiza (L.) Schleiden: 11; E22291

LILIACEAE

- Alettris farinosa* L.: 4, 5, 6, 8, 9; E21234
**Asparagus officinalis* L.: 11; E21949
Maianthemum canadense Desf.: 3; P33488
Polygonatum commutatum (Schult.) A. Dietr.: 9, 10; E21284
Smilacina racemosa (L.) Desf.: 9, 10; E21305
Smilacina stellata (L.) Desf.: 9, 10; E21280

ORCHIDACEAE

- Liparis liliifolia* (L.) Rich.: 3; P33034
Liparis loeselii (L.) Rich.: 3; F985
Platanthera flava (L.) Lindl. var. *herbiola* (R. Br.) Luer: 4; P33049
Platanthera lacera (Michx.) G. Don: 8; E21982
Spiranthes cernua (L.) Rich.: 5, 8; E22648

POACEAE

- **Agrostis gigantea* Roth: 5, 11; E21236
Agrostis hyemalis (Walt.) BSP.: 3, 4, 5, 8, 11; E21902
Agrostis scabra Willd.: 3, 4, 6, 7, 9, 10; E22413
Alopecurus carolinianus Walt.: 11; E21894
Andropogon gerardii Vitman: 5, 6, 7, 8, 9, 10; E22556
Andropogon virginicus L.: 8; P36273
Aristida basiramea Engelm.: 7, 10; E22415
Aristida purpurascens Poir.: 7, 10; E21503

- Aristida tuberculosa* Nutt.: 7, 10; E22416
Bouteloua curtipendula (Michx.) Torr.: 11; E22506
**Bromus commutatus* Schrad.: 11; E21872
**Bromus inermis* Leyss.: 10, 11; E21862
**Bromus japonicus* Thunb.: 11; Ev102859
Bromus latiglumis (Shear) Hitchc.: 11; P33467
**Bromus tectorum* L.: 11; E21621
Calamagrostis canadensis (Michx.) P. Beauv.: 2, 8; E21811
Cenchrus longispinus (Hack.) Fern.: 11; E22297
**Dactylis glomerata* L.: 11; E21618
Danthonia spicata (L.) Roem. & Schultes: 9, 10; F989
Dichanthelium lindheimeri (Nash) Gould: 3, 6, 7, 10, 11; E21259
Dichanthelium meridionale (Ashe) Freckm.: 11; E21954
Dichanthelium oligosanthes (Schult.) Gould: 7, 9, 10, 11; E21258
Dichanthelium perlongum (Nash) Freckm.: 7, 9, 10; E21853
Dichanthelium villosissimum (Nash) Freckm.: 7, 9, 10, 11; E21249
Digitaria filiformis (L.) Koel.: 9, 11; P33697
**Digitaria ischaemum* (Schreb.) Schreb.: 11; E22299
**Digitaria sanguinalis* (L.) Scop.: 11; E22300
**Echinochloa crus-galli* (L.) P. Beauv.: 2, 11; E21497
Elymus canadensis L.: 11; P33656
Elymus virginicus L.: 11; E22262
**Elytrigia repens* (L.) Desv.: 11; E21869
**Eragrostis cilianensis* (All.) Vign.: 11; E22534
Eragrostis hypnoides (Lam.) BSP.: 11; E22480
Eragrostis pectinacea (Michx.) Nees: 11; E22308
Eragrostis spectabilis (Pursh) Steud.: 7, 9, 10; E22510
Glyceria septentrionalis Hitchc.: 1; E21974
Glyceria striata (Lam.) Hitchc.: 2; E22003
Heterostipa spartea (Trin.) Barkworth: 7, 9, 10; E21281
Hierochloë odorata (L.) P. Beauv.: 5; F988
**Hordeum jubatum* L.: 11; E21884
Koeleria macrantha (Ledeb.) Spreng.: 7, 9, 10, 11; E21269
Leersia oryzoides (L.) Swartz: 2, 11; E22641
Leersia virginica Willd.: 3, 9; P33651
Leptoloma cognatum (Schult.) Chase: 7, 10; E21245
Muhlenbergia mexicana (L.) Trin.: 2, 3, 5, 9; P33476
Muhlenbergia schreberi J.F. Gmel.: 11; P33640
Panicum capillare L.: 11; Ev85024

- Panicum dichotomiflorum* Michx.: 11; E22564
Panicum rigidulum Bosc: 3, 8, 9, 10; E21496
Panicum virgatum L.: 5, 6, 8, 9, 10, 11; E22550
Paspalum bushii Nash: 7, 10; E 21511, E22260
Paspalum laeve Michx.: 11; P33645
**Phalaris arundinacea* L.: 2, 3; E21814
**Phleum pratense* L.: 11; E21299
**Poa compressa* L.: 9, 10, 11; E21923
**Poa pratensis* L.: 2, 5, 6, 7, 8, 9, 10, 11; E21604
Schizachyrium scoparium (Michx.) Nash: 5, 6, 7, 8, 9, 10; E21506
**Setaria faberi* R.A.W. Herm.: 11; E22298
**Setaria viridis* (L.) P. Beauv.: 11; E30034
Sorghastrum nutans (L.) Nash: 5, 6, 8; E22561
Spartina pectinata Link: 1, 3, 5, 8; E22342
Sphenopholis obtusata (Michx.) Scribn.: 2, 11; E21879
Sporobolus clandestinus (Biehler) Hitchc.: 7, 9, 10; E21500
Sporobolus cryptandrus (Torr.) Gray: 11; E22405
Tridens flavus (L.) Hitchc.: 6, 7, 9, 10, 11; E22546
Triplasis purpurea (Walt.) Chapm.: 7, 9, 10; E22409
Vulpia octoflora (Walt.) Rydb.: 7, 9, 10; E21855

POTAMOGETONACEAE

- **Potamogeton crispus* L.: 1; P30046
Potamogeton foliosus Raf.: 11; P33663
Potamogeton nodosus Poir.: 11; P33658

SMILACACEAE

- Smilax lasioneuron* Hook.: 11; E21873

SPARGANIACEAE

- Sparganium eurycarpum* Engelm.: 1; E21970

TYPHACEAE

- Typha latifolia* L.: 1, 2, 11; P33486

XYRIDACEAE

- Xyris torta* Sm.: 8, 11; E22315